

The logo is a circular emblem. The outer ring contains the text "NPOESS PREPARATORY PROJECT" at the top and "THREE AGENCIES • ONE MISSION" at the bottom. The inner circle features a stylized globe with a satellite in orbit, emitting a rainbow-colored arc. Below the globe is a small satellite ground station with a dish antenna.

NPOESS Preparatory Project (NPP)

Confirmation Readiness Review (CRR)

Jim Watzin
Project Manager

August 26, 2003

Revision A

Agenda

- | | |
|---|-------------------|
| • Introduction | J. Watzin |
| • Mission Overview | J. Watzin |
| • Science Overview / Objectives | R. Murphy |
| • Programmatic | J. Watzin |
| • SRO Program Assessment | D. Dillman |
| • SMO NPG 7120.5B Compliance | B. Keer |
| • Non-Advocate Review Report | S. Battel |
| • SMO RAO Cost and Schedule Assessment | C. Fryer |
| • Project Summary / Response | J. Watzin |
| • EOS Program Recommendation | G. Morrow |

Mission Confirmation Summary (1)

- **Several loose ends still remain...**
 - Mission Level 1 Requirements document is in draft form, primarily due to SDS related issues
 - Final Implementation Agreement is in HQ review cycle (significant re-write)
 - Implementation Agreement with NOAA for ADS is in draft form at HQ
 - Mission success criteria pending from HQ
 - Decision on CERES instrument pending HQ approval; although the draft Mission Level 1 Requirements document contains CERES
 - IPO / NGST contract contains no provisions for CERES accommodation
- **Systems Management Office (SMO) interaction has been good and assessment is accurate. The Project is coordinating identified issues and concerns with the SMO and has generated a closure plan**

Mission Confirmation Summary (2)

- **SMO Resource Analysis Office (RAO) Parametric Cost Estimate correlates well with the Project's Grass Roots Estimate when adjusted for model inconsistencies**
- **SMO NPG 7120.5B audit was completed on August 12, 2003. Several non-compliances (3) and planning deficiencies (4) were identified and have been discussed with the SMO. Action to close the non-compliances has been initiated and a closure plan for the deficiencies has been generated**
- **Non-Advocate Review Team interaction has been good; Issues (4) / Concerns (5) are fair and a closure plan has been generated by the Project. IPAO Independent Cost Estimate is correlation is good**

Mission Confirmation Flow

| | |
|---|-------------|
| ✓ Mission PDR/NAR Meeting | 1/03 |
| ✓ Spacecraft CDR/NAR Meeting | 6/03 |
| ✓ NAR Meeting | 7/03 |
| ✓ NAR Pre-Brief to Project | 8/15 |
| ✓ GSFC RAO Pre-Brief to Project | 8/20 |
| ➤ Goddard PMC MCRR | 8/26 |
| • Earth Science Steering Committee Briefing | 8/27 |
| • Center Director Briefing | 9/3 |
| • Earth Science Enterprise PMC MCR | 9/8 |
| • Agency PMC MCR | 9/15 |

Mission Overview

NPP Definition

- **NPP is a joint partnership between NASA's Office of Earth Sciences (OES) and the NPOESS Integrated Program Office (IPO) initiated in 1998**
 - Feasibility study began in November 1998
 - Formulation began in November 1999
- **The partnership provides both organizations with considerable cost savings while achieving their key program objectives:**
 - To provide NASA with continuation of a group of global change observations initiated by the Earth Observing System (EOS) TERRA, AQUA, and Aura missions.
 - To provide the NPOESS operational community (both DoD and the NOAA) with pre-operational risk reduction demonstration and validation for selected NPOESS instruments, and algorithms, as well as ground processing.

Nature of Program

- **Peer-to-Peer Partnership**
 - NASA / IPO / NOAA / DoD
- **Shared Risk**
 - Agency-centric vulnerabilities
- **Shared Control**
 - Joint Project Management
 - Joint award fee representation
- **Joint Oversight**
 - Tri-Agency Steering Committee
 - Executive Committee (EXCOM)
- **No Exchange of Funds**
 - Each partner will contribute mission components “in-kind”

NPP Roles/Responsibilities

IPO

- Joint Program Management
- VIIRS Instrument
- CrIS Instrument
- OMPS Instrument
- Command, Communications, Control Segment (C3S)
- Interface Data Processing Segment (IDPS)
- Mission Operations

NASA

- Joint Program Management
- Mission systems engineering, integration, and test
- ATMS Instrument
- CERES Instrument
- Spacecraft and integration
- Launch vehicle and associated activities
- Science Data Segment (SDS)

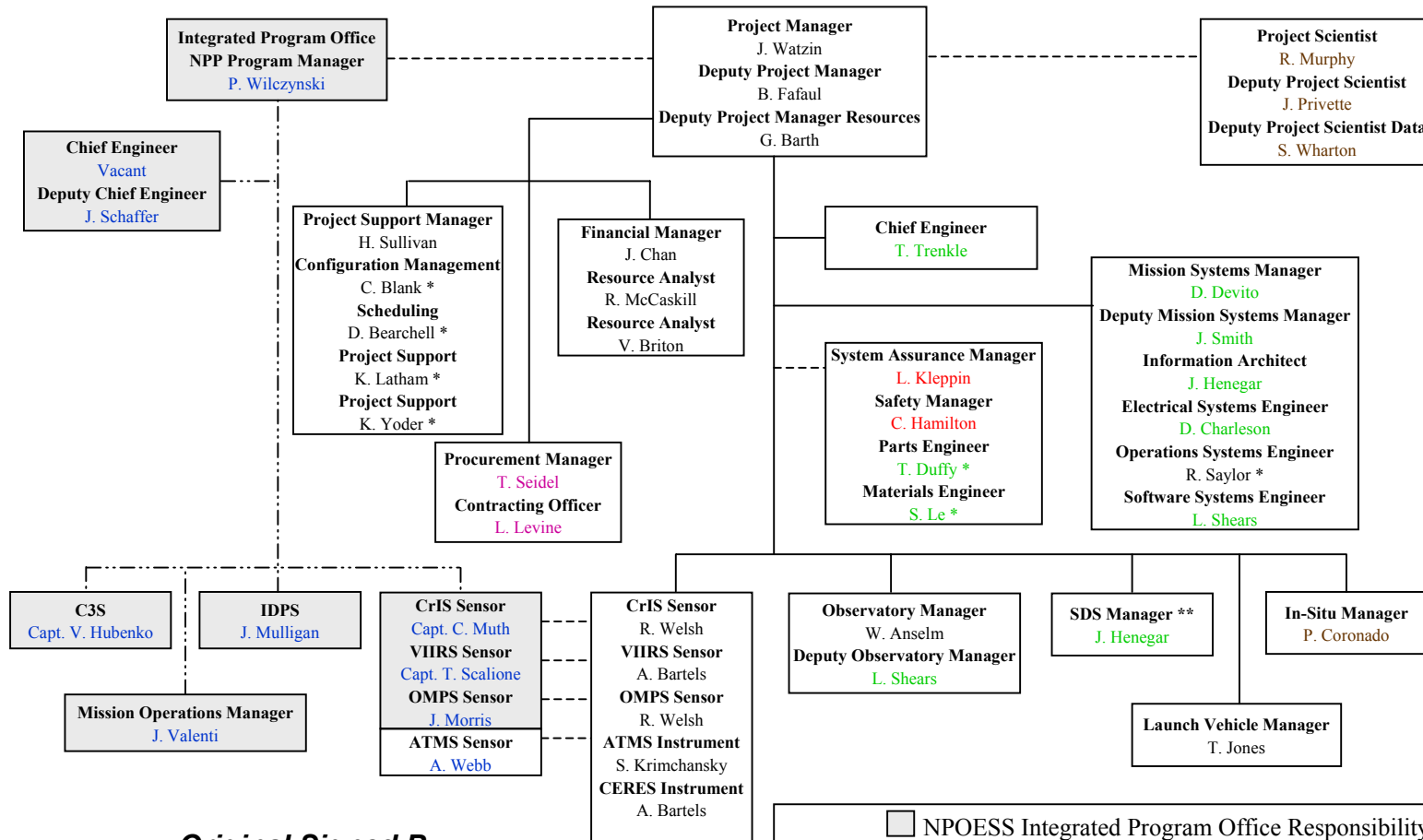
NOAA/NESDIS

- Archive & Distribution Segment (ADS)

NPP Organization

NPOESS Preparatory Project Code 429

July 14, 2003



Original Signed By

James Watzin, NPP Project Manager

Date

☐ NPOESS Integrated Program Office Responsibility

IPO = Blue

Code 200 = Violet

Code 300 = Red

Code 400 = Black

Code 500 = Green

Code 900 = Brown

* Contractor

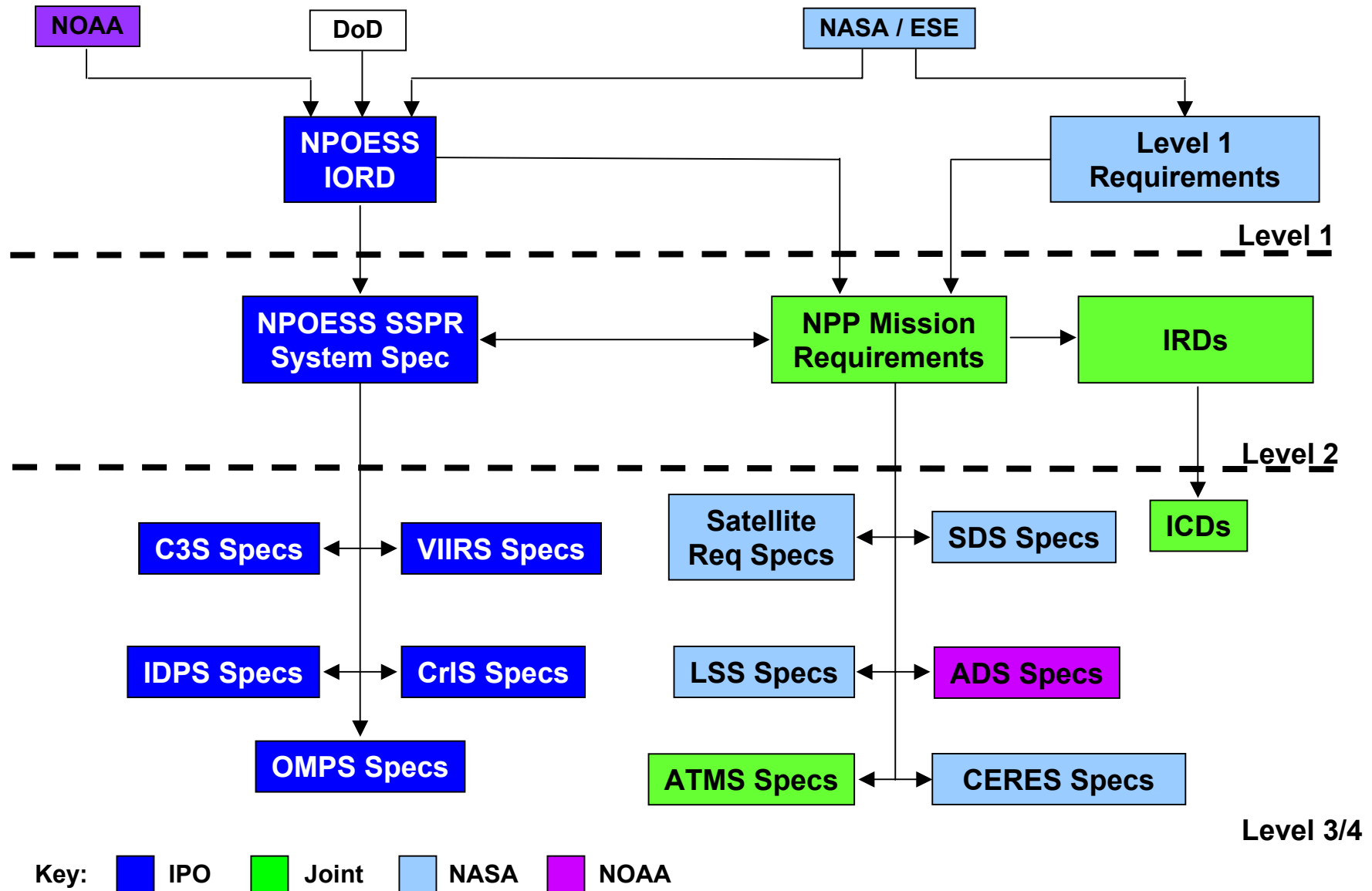
** Joint with ESDIS

--- IPO Internal

Project Management Approach

- **Keys to NPP success**
 - Careful blending of different cultures (NASA, DoD, NOAA)
 - Inclusive processes
 - Treat partners as partners, not subordinates
 - Risks are shared, not controlled by any single stakeholder
 - Clear responsibilities and mission objectives / requirements
 - Social interaction and teambuilding
 - Program support from sponsors
- **NPP staffed with experienced personnel to maximize lessons learned**
 - AMSU (same contractor used for ATMS)
 - ICESat (common Ball spacecraft)

Requirements Hierarchy



Level 1 Requirements Summary (1)

- Space Element Performance (DRAFT):
 - The NPP spacecraft shall be designed for a 5-year lifetime with a probability of success of 0.85, and shall accommodate the ATMS, CrIS, VIIRS, OMPS, and CERES instruments
 - The NPP spacecraft shall have the ability to perform a deep space calibration maneuver in support of the VIIRS instrument
 - The NPP spacecraft shall support concurrent operation for all 5 instruments, and be capable of downlinking all observed data each orbit to the mission ground system
 - Real-time X-band direct broadcast of VIIRS, CrIS, and ATMS instrument data shall be provided to the direct broadcast community
 - The ATMS instrument shall be designed for a 7-year lifetime with a probability of success of 0.86
 - The CERES instrument shall be verified to support a 5-year lifetime.
 - The NPP observatory shall be launched and operated in a polar sun-synchronous orbit having the following characteristics:
 - Nominal altitude of 824 +/- 17 kilometers (km)
 - Ground track repeat accuracy of 20 km at the Equator, repeat cycle will be less than 20 days
 - Nominal descending equatorial crossing time of 10:30 AM +/- 10 minutes

Level 1 Requirements Summary (2)

- Science Data Segment (SDS) Performance Requirements (DRAFT) (1)
 - The NPP Science Data Segment (SDS) is a prototype element for the future ESE distributed science data system. In this case, the SDS is intended to be a research tool and as such has no operational requirements. Operational requirements are met by the other two elements of the NPOESS/NPP data system the IDPS and the Archive & Distribution Segment (ADS). The SDS is dependant on the NOAA ADS as the source for data records (RDRs, SDRs and EDRs). As a prototype, the elements of the SDS should maximize the interoperability with other ESE assets. A role of the NPOESS/NPP data system (IDPS, ADS, SDS) is to produce climate quality EDRs. The role of the NPP SDS is limited to testing the usefulness of the NPP EDRs for accomplishing climate research.
 - The SDS shall be designed with the assumption that the operational IPO IDPS generated NPP EDRs do not require reprocessing or re-computation in order to support climate research needs. Consequently, the SDS will not be designed to generate data products which require long-term archival in the ADS.
 - The NOAA ADS will provide the active and long-term data archive for NPP mission data. The SDS shall acquire RDRs, SDRs and EDRs from the ADS.
 - In developing the SDS, the Project shall assume that EDRs produced by the IDPS are climate quality and put in place the capability to test that hypothesis in order to contribute to improving the quality of future EDRs. The SDS shall provide suggested algorithm improvements to the IDPS.

Level 1 Requirements Summary (3)

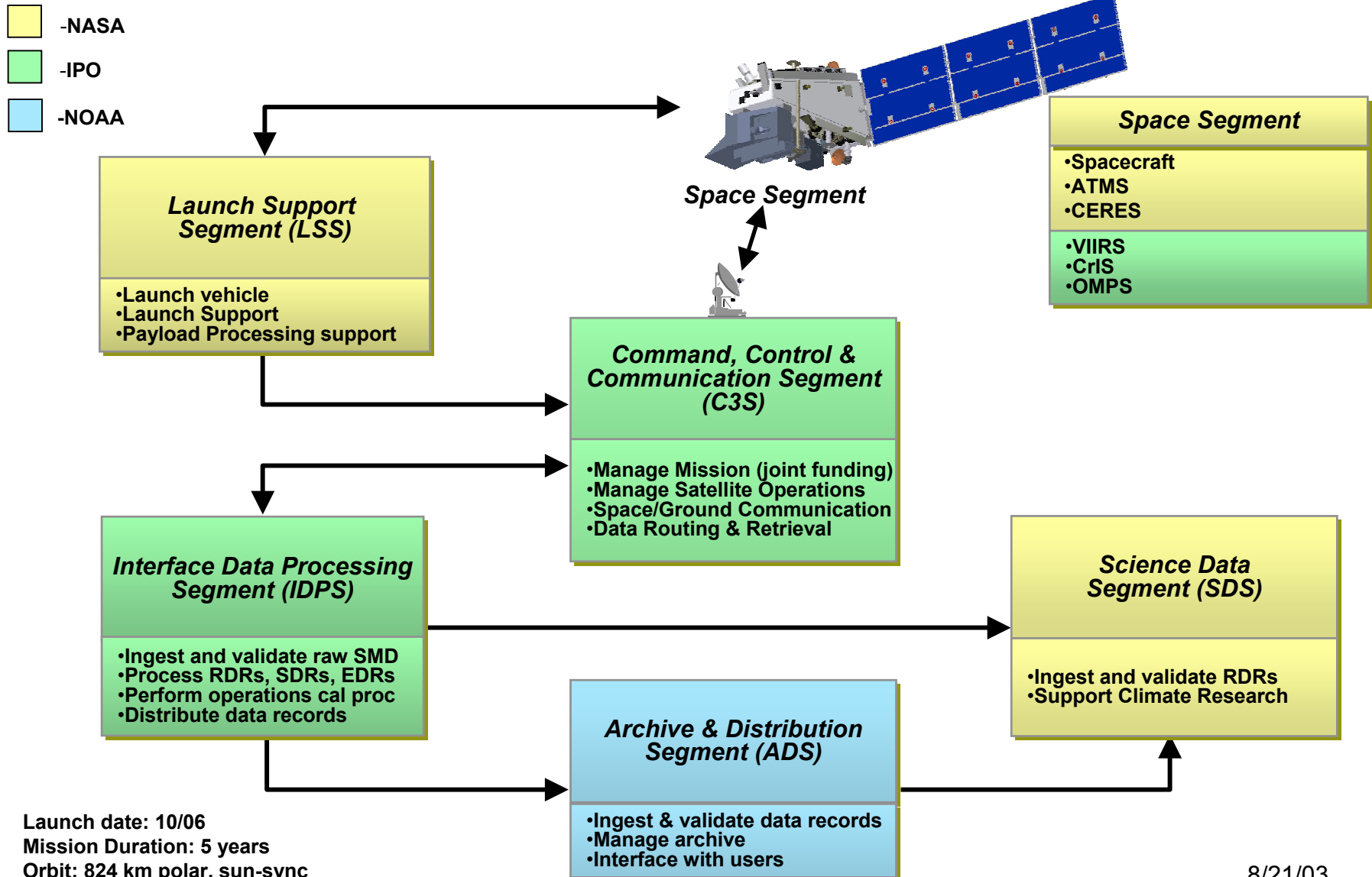
- Science Data Segment (SDS) Performance Requirements (DRAFT)(2)
 - The SDS shall use a fully distributed interoperable architecture, with 5 (nominally) functionally independent elements (Climate Analysis Research System or CARS), organized around key EDRs (atmospheric sounding products, ocean products, land products, ozone products and atmospheric composition) in support of the ESE Science Focus Areas (Atmospheric Composition, Climate Change, Carbon/Ecosystems, Solid Earth, Weather, Water/Energy Cycle)
 - The CARS shall leverage the existing resources (e.g., the Science Investigator-led Processing Systems, the Earth Science Information Partners, the REASON CAN participants, EOSDIS, other national and international labs) to the maximum extent possible. The CARS will have government oversight and may be physically located anywhere. The NPP Science Team and other appropriate science measurement teams shall assist in addressing the roles and functionality of the SDS.
 - The NPOESS IDPS will not process the NPP/CERES data into sensor data records (SDRs) or environmental data records (EDRs), but rather will only provide only RDR data. The existing capability for production of radiation balance products shall be leveraged along with all other NASA assets to the maximum extent possible. These capabilities shall evolve into the radiation balance CAR.

Level 1 Requirements Summary (4)

- **Schedule Requirements (DRAFT)**
 - **NPP observatory launch readiness date shall be no later than Oct. 31, 2006**
 - **At launch, the NPP SDS shall be capable of processing select data subsets in order to conduct independent analysis in support of the IPO NPP Calibration/Validation activities**
- **Budget Requirements (DRAFT)**
 - **The total, full cost accounted, budget for the NPP Project to satisfy the performance requirements in Section 2.1, is \$M. The SDS shall be developed on a prioritized science measurement basis within a NTE of \$ TBD. KSC non-direct costs (i.e. full cost) are not included. Further, NASA Corporate G&A is not included in this number. This budget will be reviewed annually to reflect Center rate changes.**
 - **The funding summary is:**

| Prior | FY03 | FY04 | FY05 | FY06 | FY07 | Total |
|-------|------|------|------|------|------|-------|
| | | | | | | |

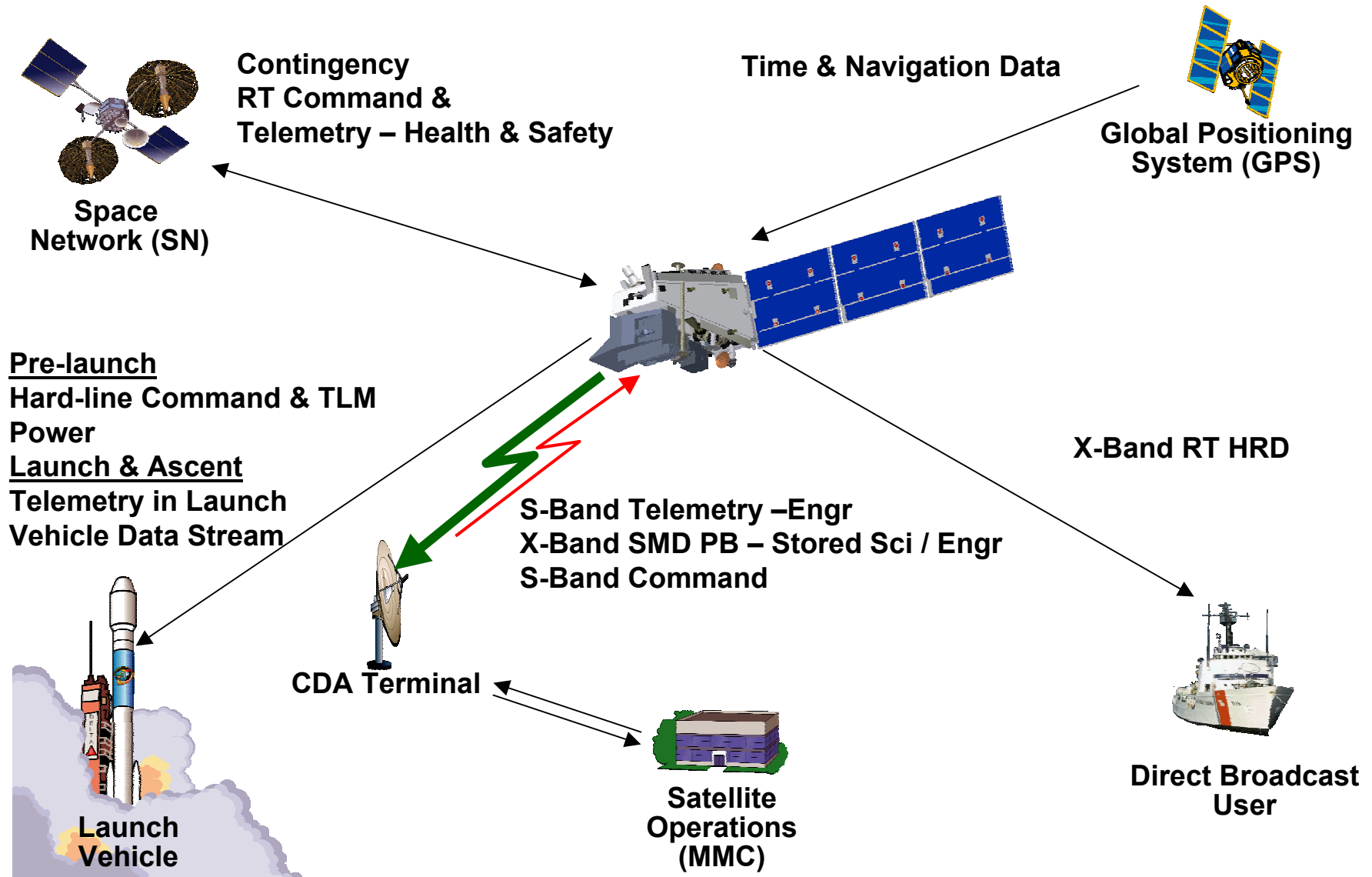
NPP Mission Segments



Launch date: 10/06
Mission Duration: 5 years
Orbit: 824 km polar, sun-sync

8/21/03

Satellite External Interfaces

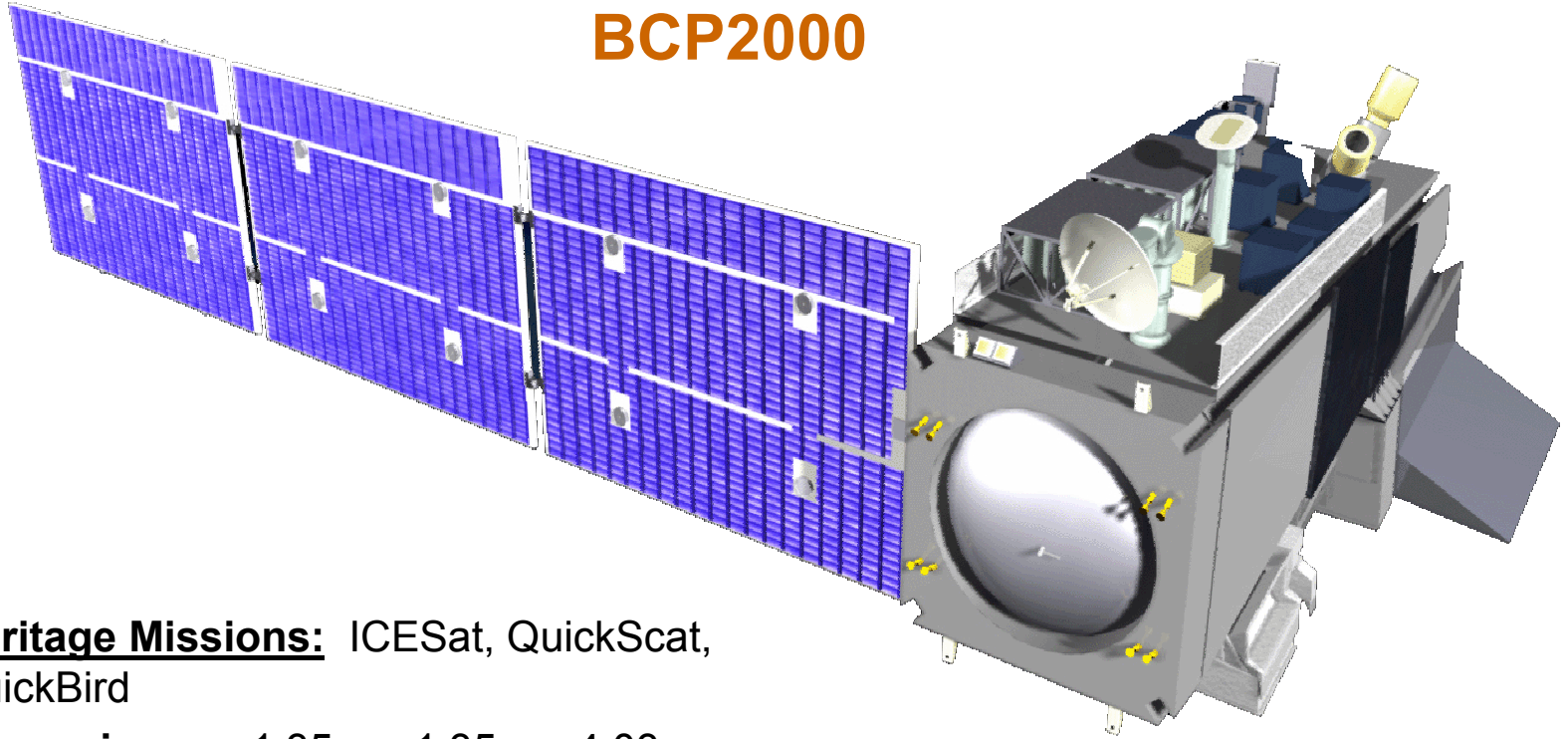


NPP Development Contractors

| H/W Element | Contractor | Agency | Contract Type | Status |
|-----------------------|-----------------------|------------------|---------------|---|
| ATMS | NGES | NASA-GSFC | CPAF | EDU Assembly |
| CERES | NGST | NASA-LaRC | CPAF | Complete |
| CrIS | NGST/ ITT | IPO | CPAF | EDU Development |
| OMPS | NGST/ Ball Aerospace | IPO | CPAF | EDU Development |
| VIIRS | NGST/ Raytheon | IPO | CPAF | EDU Development |
| Satellite | Ball Aerospace | NASA-GSFC | FFP | Post CDR Implementation |
| Launch Vehicle | Boeing | NASA-KSC | FFP | Initiate L-27 |
| C3 | NGST/ Raytheon | IPO | CPAF | Critical Design Audit |
| IDPS | NGST/ Raytheon | IPO | CPAF | Critical Design Audit |
| ADS | CSC | NOAA | CPAF | Under Development |
| SDS | TBD | NASA-GSFC | TBD | Awaiting Approved Level 1 Requirements |

NPP Satellite

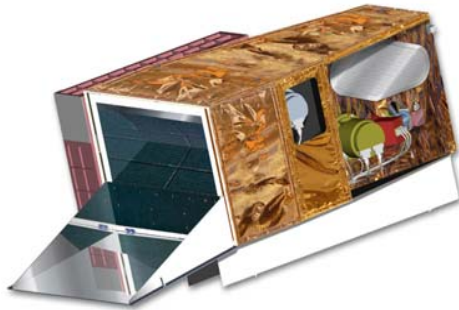
BCP2000



- **Heritage Missions:** ICESat, QuickScat, QuickBird
- **Dimensions:** ~1.35m x 1.35m x 4.03m
- **Mass:** 2300 kg
- **Power:** 2.4 kw
- **TRL:** 8.5

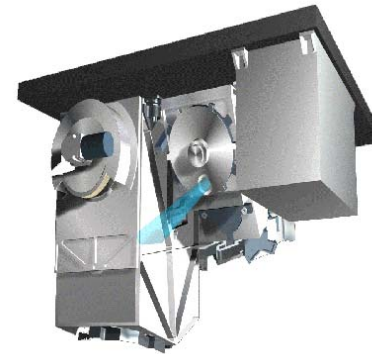
Instrument Technology Summary

VIIRS



- **Purpose:** Global observations of land, ocean, & atmosphere parameters at high temporal resolution (~ daily)
- **Predecessor Instruments:** AVHRR, OLS, MODIS, SeaWiFS
- **Approach:** Multi-spectral scanning radiometer (22 bands between 0.4 μm and 12 μm) 12-bit quantization
- **Swath width:** 3000 km
- **TRL:** 6.5

OMPS



- **Purpose:** Monitors the total column and vertical profile of ozone
- **Predecessor Instruments:** TOMS, SBUV, GOME, OSIRIS, SCHIAMACHY
- **Approach:** Nadir and limb push broom CCD spectrometers
- **Swath width:** 2600 km
- **TRL:** 6.5

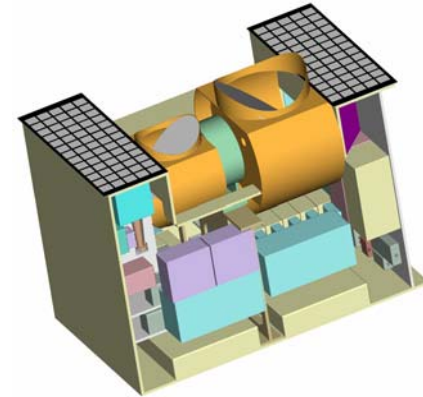
Instrument Technology Summary

CrIS



- **Purpose:** In conjunction with ATMS, global observations of temperature and moisture profiles at high temporal resolution (\sim daily).
- **Predecessor Instruments:** HIRS, AIRS, IASI
- **Approach:** Michelson interferometer (1142 channels in 3 bands ($3.5 \mu\text{m}$ >> $16 \mu\text{m}$))
- **Swath width:** 2300 km
- **Co-registration:** with ATMS
- **TRL:** 6.5

ATMS



- **Purpose:** In conjunction with CrIS, global observations of temperature and moisture profiles at high temporal resolution (\sim daily).
- **Predecessor Instruments:** AMSU A1 / A2, MHS
- **Approach:** Scanning passive microwave radiometer (22 channels (23 GHz >> 183 GHz))
- **Swath width:** 2300 km
- **Co-registration:** with CrIS
- **TRL:** 6.5

Instrument Technology Summary

CERES



- **Purpose:** Measures the Earth's energy balance by making measurements of the earth's radiant and emitted energy
- **Predecessor Instruments:** Currently flies on TRMM, Terra and Aqua; ERBE
- **Approach:** Scanning bolometer telescopes
- **Swath width:** Limb-to-limb
- **TRL:** 9

NPP Development Status

- **ATMS, VIIRS, CrIS, and OMPS instruments have completed detailed design reviews. Engineering Development Units are in process**
- **CERES has been built, but must be evaluated and qualified for NPP mission**
 - Not yet approved for this mission
- **NPP Spacecraft contractor has completed Critical Design Review (June 2003)**
- **KSC will procure launch services for NPP approximately L-27 months**
 - Initial “special studies” task has been opened
- **Command & Control (C3) and operational ground data systems (IDPS) under development by IPO’s NPOESS contractor (NGST)**
- **NOAA’s Comprehensive Large Array-data Stewardship System (CLASS) is under development. The Archive and Distribution Segment (ADS) will evolve as part of this effort**
- **NASA’s Science Data Segment conceptual requirements and budget are being defined**
 - Not a mission critical element

Descope Options

- **There are no significant descope options that can be unilaterally exercised without impacting overall mission success**
 - Fly without either CERES or OMPS if significant schedule benefits realized
 - Product performance specification waivers – waive specification requirements if significant schedule or cost savings realized and assessments have been made to EDR / CDR performance
- **Descope actions required due to cost or schedule considerations must be directed by the Tri-Agency Executive Committee (EXCOM)**

NASA Systems Responsibilities

- **Overall mission systems engineering responsibility**
- **Requirements Management**
 - NASA and NGST requirements tracibility maintained through relational database (DOORS)
- **System Architecture Stewardship**
- **Flight Segment Validation**
- **Operational Readiness**
- **Launch and Early Orbit (~90 days) Spacecraft Control Authority**

In Summary, Ensure That All Elements Play Together

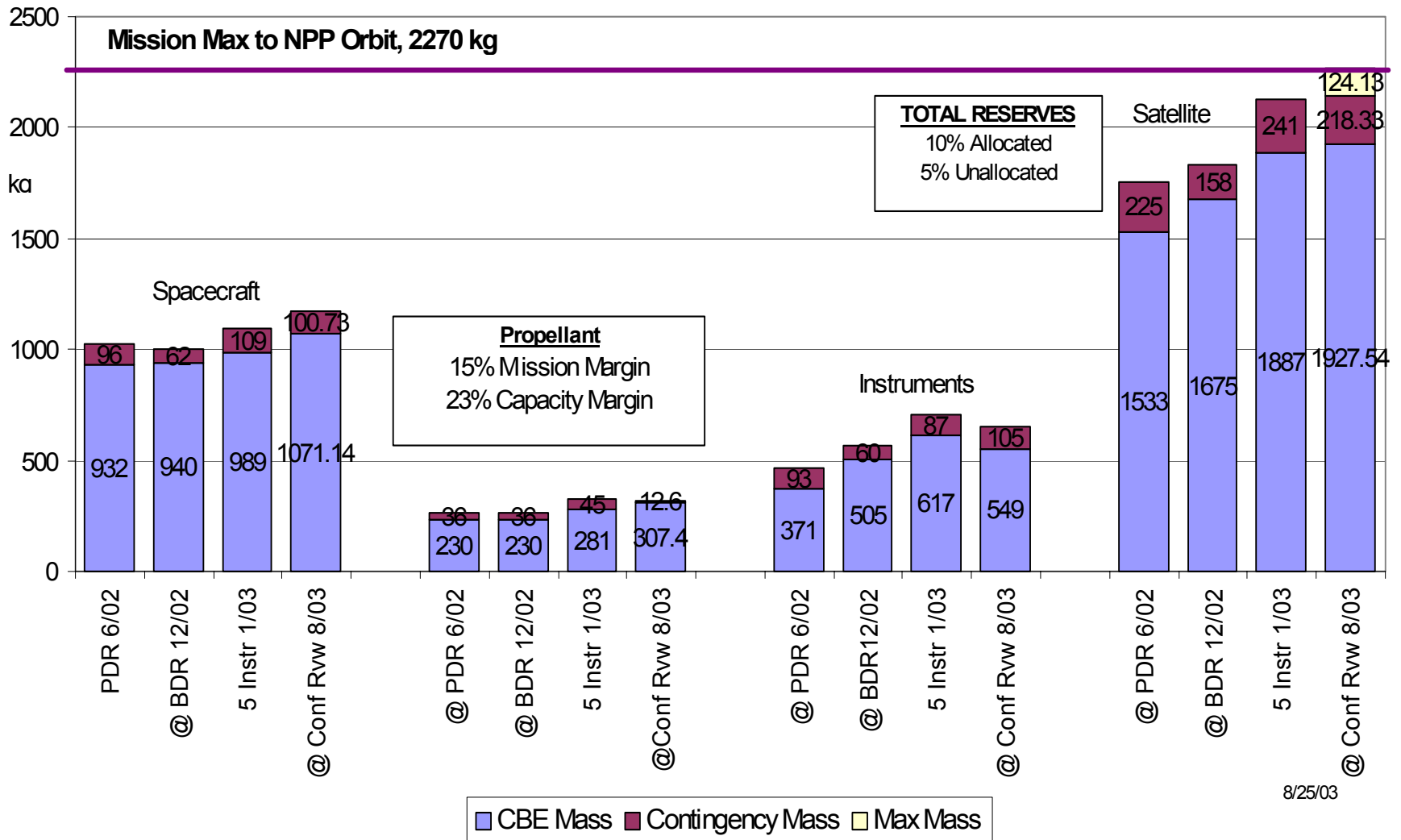
Integrated System Management Approach

| Working Group | Charter | Chair(s) | Major Activities |
|--|---|--|--|
| <u>System Engineer Working Group (SEWG)</u> | Responsible for executing SE process and development of SE products | NPP Systems Manager & Co-chaired by IPO NPP SE Lead | Management of systems requirements and technical baseline <ul style="list-style-type: none"> - Resolution of system level and inter-segment technical issues - Development and maintenance of inter-segment and external interface requirements documents - System level risk monitoring / management - Coordination of system level reviews - Monitor/review developer's risk management databases, DRs, NCRs etc. |
| <u>System Integration and Test Working Group (SITWG)</u> | Focal point for developing, executing, integration, test, and verification plans across NPP System | Chaired by NPP Dep System Manager and Co-chaired by IPO Test Lead | <ul style="list-style-type: none"> - Development and maintenance of PVP and NPP SI&T Plan - Coordination of IMS - Coordination of I&T activities across segments at system level - Coordination of schedules and activities associated with system level test - Participates/has insight into element and segment level I&T as preparation for system I&T - Coordination of system I&T objectives, plans, procedures, and configurations, including NCTs, stress/performance tests - Leads regular SITWG meetings with members from all segments/contractors and maintains status |
| <u>Mission Operations Working Group (MOWG)</u> | Focal point for mission operations and launch readiness | Chaired by NPP Mission Readiness Manager and Co-chaired by IPO Mission Ops Manager | <ul style="list-style-type: none"> - Plan and coordinate mission OREs, ORT, launch rehearsals of entire system - Coordinate readiness of ops procedures/training, certification - Satellite commissioning - Transition planning |
| <u>Satellite – C3S Ground Interface Working Group (SCWG)</u> | Focal point for satellite and C3S interface definition | Co-chaired by NPP Observatory Manager and IPO C3S Lead | <ul style="list-style-type: none"> - Coordinate SS to C3S interface definition and issue resolution - Coordinate DFCB development - S/C Sim, SIIS, S/C C&T Sim, FVS - Command databases |
| <u>Space Segment Working Group (SSWG)</u> | Focal point for coordinating intra-space segment development and integration issues | Co-chaired by NPP Observatory Manager and IPO SS Lead | <ul style="list-style-type: none"> - Coordination of intra-segment interface design and trades - Coordination of GSE needs, deliveries, and procedures - Simulated telemetry test data generation and use |
| <u>Launch Working Group (LWG) / Launch Operations Working Group (LOWG)</u> | Focal point for LSS interfaces with SS and C3S; launch operations prep | Co-chaired by NPP Launch Manager and KSC MIM | <ul style="list-style-type: none"> - Coordinate SS to LSS interface definition and issue resolution - Coordinate LSS services requirements - Coordinate launch site ops prep |
| <u>Data System Working Group (DSWG)</u> | Focal point for coordinating and resolving development and integration items relevant to the information architecture | Co-chaired by NPP Information Architect and IPO IDPS Lead | <ul style="list-style-type: none"> - Coordination of the end-to-end information architecture - Coordination of mission data and metadata content, formats, standards - Coordination of mission data interface design and trades |

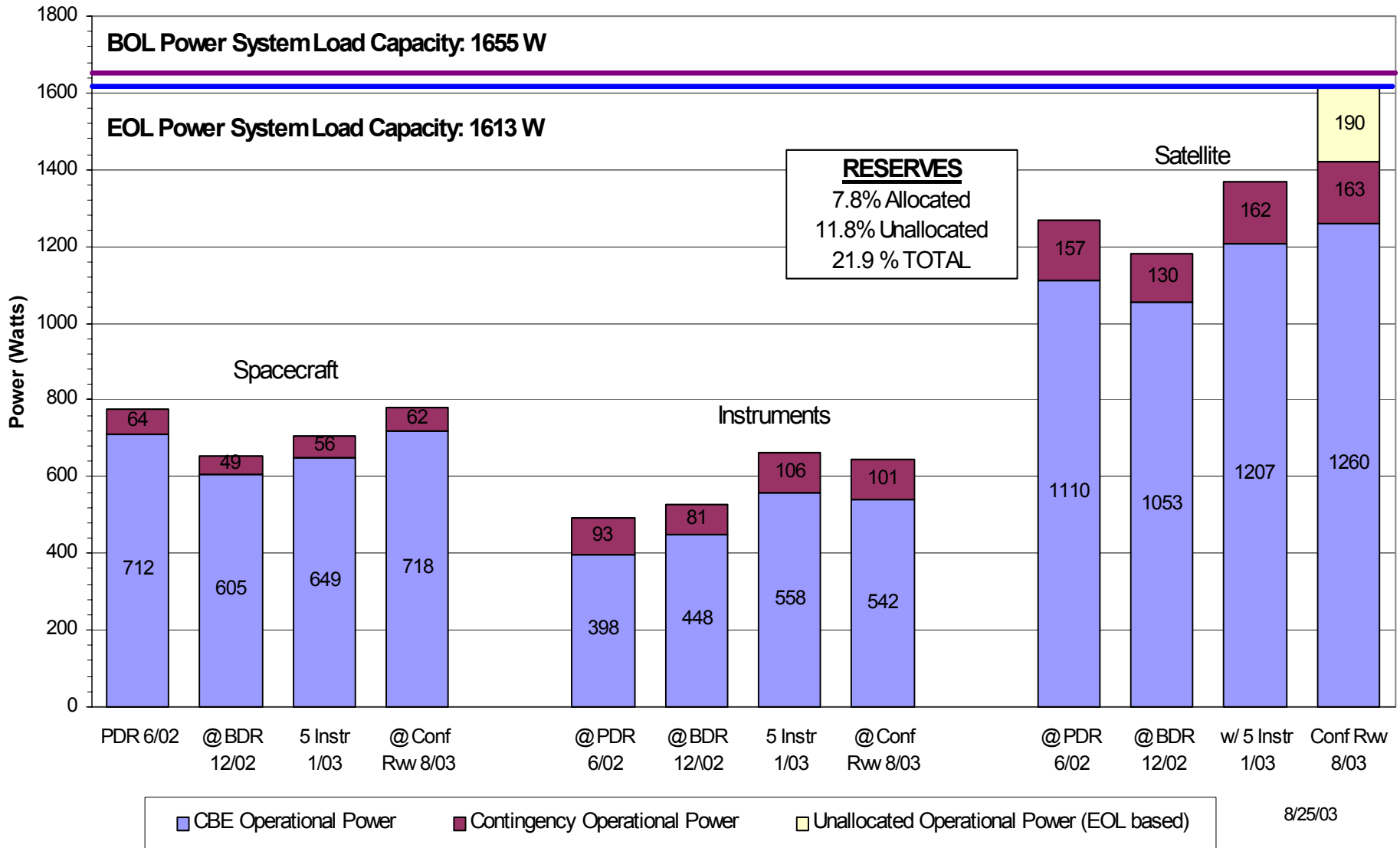
NPP Engineering Review Board

- **Manages the NPP mission technical baseline**
- **Management responsibilities include:**
 - Coordinating space and ground systems configuration throughout development and deployment
 - Managing the system integration plans
 - Approving risk items
 - Resolving technical issues
 - Coordinating programmatic activities
 - Coordinating review/approval of NPP products and documents as applicable
 - Change Management:
 - Coordinating technical changes
 - Reviewing and dispositioning system level discrepancy reports
- **Chair: NPP System Manager**
- **Co-Chair: NPOESS IPO System Engineer**

Mass History



Operational Power History



Project Design Drivers and Principle Challenges

- **Multi-Agency, Multi-Contract, Multi-Mission**
 - Coordination
 - Mixed goals and requirements
- **ATMS Miniaturization**
 - Monolithic Microwave Integrated Circuit (MMIC) development
 - System Packaging

Safety and Mission Assurance Overview (1)

- **Safety and Mission Assurance (SMA) Program based on GPG 7120.2, Project Management, and GSFC 300-PG-7120.2.1, Mission Assurance Guidelines Implementation**
 - NPP Systems Safety and Mission Assurance Plan (GSFC 429-00-01-06) details the SMA approach
- **Explicit SMA requirements established for NASA-managed spacecraft and ATMS instrument via contractual Mission Assurance Requirements (MAR) documents**
 - Accommodates NPOESS requirements
 - Establishes parts, materials and workmanship requirements
 - Non-conformance reporting
 - Material Review Boards
 - Establishes Reliability analyses including FMEA, FTA and PRA
 - Establishes requirements for inspection and verification
 - Tailored as appropriate for contract type (Fixed Price for spacecraft vs. Cost Plus Award Fee for ATMS instrument)

Safety and Mission Assurance Overview (2)

- **CERES instrument developed under the General Interface Requirements Document for EOS Common Spacecraft/Instruments, GSFC 422-11-12-01, and EOS Performance Assurance Requirements for EOS General Instruments, GSFC 420-05-01**
 - Compatible with NPP requirements, no additional SMA requirements have been levied to date
- **CrIS, VIIRS and OMPS SMA requirements established in Northrop-Grumman (NGST) Engineering Manufacturing Development (EMD) contract**

Inspection / Surveillance

- **ATMS government inspection provided by NASA QAR and Defense Contract Management Agency (DCMA) personnel at Northrop-Grumman**
 - ATMS Fabrication, Assembly and Test Flow Plan (CDRL 013) details Northrop-Grumman, DCMA and NASA Quality Assurance Representative inspection points
- **Letter of Delegation to DCMA Ball provides for government inspection**
 - Requires DCMA pre-closure inspection of the NPP spacecraft bus prior to the start of acceptance testing for configuration verification, test set-up and general mechanical and electrical workmanship
- **Project currently incorporating surveillance approach, consistent with risk management, into a consolidated Project Surveillance Plan and updating contract surveillance plans commensurate with risk**

Software Quality Assurance

- **Software quality assurance requirements included in MAR**
- **Ball's software plan submitted as part of the Rapid Spacecraft Development Office (RSDO) on-ramp documentation, reviewed and found acceptable**
- **Independent Verification and Validation (IV&V) provided by NASA IV&V facility through Memorandum Of Agreement for ATMS instrument and spacecraft software**
 - Remaining scope being coordinated for FY04 and FY05

Reliability

- **Mission Reliability Assessments are in process**
 - Initial NPP Satellite Reliability Assessments provided by Ball
 - Failure Modes and Effects Analysis and Critical Items List, CDRL 24
 - Probabilistic Risk Assessment, CDRL 25
 - Fault Tree Analysis, CDRL 26
 - Single Point Failure Assessment
 - ATMS instrument reliability analyses provided by NGES
 - Failure Modes and Effects Analysis, CDRL 028
 - Reliability Assessment, CDRL 030
 - VIIRS, CrIS, and OMPS sensor reliability assessments provided by IPO / NGST
 - Preliminary Project Mission Reliability Assessment underway and is being performed by Code 302
 - Initial draft due by end of September 2003

Mission Safety

- **Compliance to EWR 127-1 required for spacecraft and instruments**
- **Ball is responsible for submission of safety package for the satellite**
- **NPP is National Environmental Policy Act (NEPA)-compliant**
 - Initial NEPA checklist submitted to Code 205 in February 2002
 - Covered by NASA Routine Payload Environmental Assessment, June 2002
 - Next Project submission of the NEPA Routine Payload Checklist planned for September 2003

NPP Science Overview

23 Earth Science Questions

- The NASA ESE objectives lead to 23 research questions framed around the overall question:
 - How is the Earth changing and what are the consequences for life on Earth?
- NPP EDRs directly address 12 of the 23 questions

Contributions to NASA Earth Science

| EOS 24 MEASUREMENTS | EOS INSTRUMENTS & EARTH PROBES | NPP Data Products | VIIRS | CrIS / ATMS | OMPS | CERES |
|-------------------------|-----------------------------------|----------------------|-------|----------------|------|-------|
| Land Cover/Land Use | ETM, MODIS, ASTER | Surf. Type, Albedo | | | | |
| Vegetation Dynamics | MODIS, MISR | Vegetation Index | | | | |
| Surface Temperature | MODIS, ASTER, ETM | Land Surf Temp | | | | |
| Fire Occurance | MODIS, ASTER, ETM, Etc | Active Fires | | | | |
| Effects of Volcanoes | MODIS, MISR, etc | (Included Above) | | | | |
| Surface Wetness | AMSR-E | Soil Moisture | | | | |
| Sea Surface Temperature | MODIS, AIRS, AMSR-E | SST | | | | |
| Phyto. Plankton | SEAWIFS, MODIS | Ocean Color | | | | |
| Surface Wind Field | SEAWINDS, AMSR-E | | | | | |
| Ocean Surf. Topo. | TOPEX/POSEIDON, Etc | | | | | |
| Cloud Properties | MODIS, MISR | Cloud Products | | | | |
| Radiative En. Fluxes | CERES, MODIS, MISR | Level 1 Radiances | | | | |
| Global Precipitation | TRMM(PR, TMI), AMSR-E | | | | | |
| Tropospheric Chem. | TES, MOPITT | Ozone only | | | | |
| Stratospheric Chem. | MLS, HIRDLS, Etc | Ozone only | | | | |
| Aerosol Properties | MODIS, MISR, Etc | Aerosol Products | | | | |
| Temperature Profile | AIRS/AMSU, HIRDLS, MLS | Temperature Profile | | | | |
| Atmospheric Profile | AIRS/AMSU, AMSR-E | Humidity Profile | | | | |
| Lightning | TRMM (LIS) | | | | | |
| Land Ice | GLAS, ETM, ASTER | | | | | |
| Sea Ice | AMSR-E, MODIS | Sea Ice Age/Motion | | | | |
| Snow Cover | MODIS, AMSR-E | Snow Cover | | | | |
| Total Solar Irradiance | ACRIM, TSIM | | | | | |
| UV Spectral Irradiance | SOLSTICE | | | | | |

Primary Contribution
Secondary Contribution



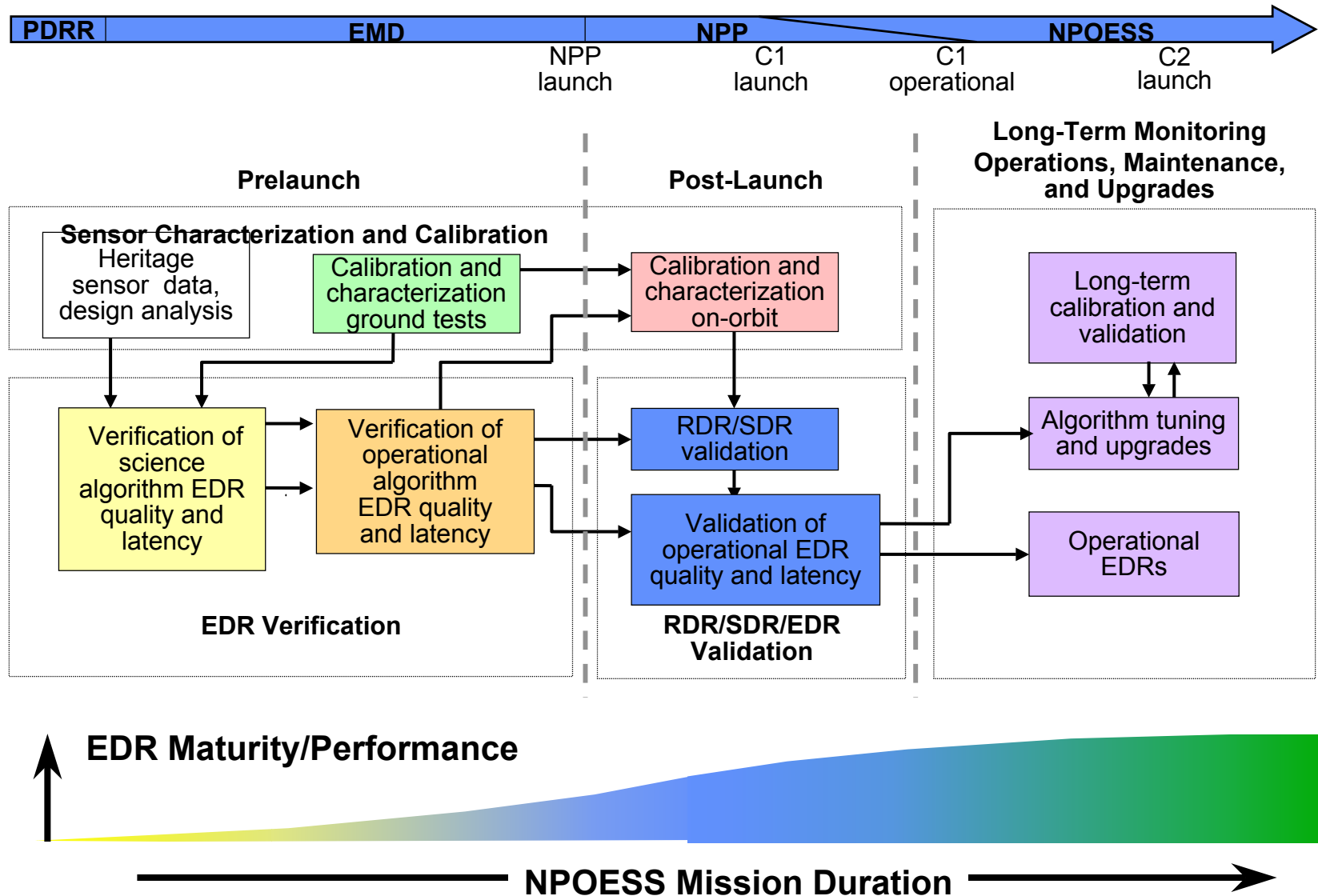
Mission Data Products

- **NPP (and later the NPOESS Space Segment) will produce sensor data for processing by the NPOESS Interface Data Processing Segment (IDPS)**
- **The IDPS will produce Environmental Data Records (EDR's) of geophysical products in an operational environment while minimizing data latency**
- **NASA, NOAA, and other agencies will leverage the operational EDR's in performing climate research**
 - ADS will archive the IDPS EDRs
 - SDS is intended to be a research tool in support of NASA's efforts

NASA's Science Involvement

- **Selection of the pre-launch NASA NPP Science Team to be announced by September 2003**
 - About 20 academic & government scientists
- **Science Team will assess EDR algorithms and sensor developments for purposes of climate study and advise Project & Program Scientists**
- **Project Science Group (PSG) consisting of GSFC in-house sensor calibration, data processing & algorithm experts**
 - Provides technical support to Science Team
 - Primary interface between Science Team & SSPR project elements
 - Overlapping membership on IPO's OATs, SSPR's IPTs & SAT
- **PSG & Science Team will work through the OATs to provide input**
- **Second phase science team to be selected near time of launch for detailed assessment of EDRs**

Phased Incremental Approach For EDR Refinement & Validation



NASA Participation in Calibration and Validation

- **Strong emphasis on pre-flight sensor characterization through PSG / OATs**
 - Level 1 algorithms & independent analysis of test data
 - EOS personnel participating bringing MODIS, AIRS, OMI, and AMSU experience
 - Developed NPOESS EDU Data Exchange Toolkit (NEXT)
 - Standard environment to interact with sensor vendor test data system
- **EDR testing through PSG and Science Team**
 - Existing resources evolving into a simulation environment
 - Key in-house expertise in algorithm design
- **Post-launch data analysis**
 - Collection of comparative data sets (field, air and satellite) planned
 - Independent analysis of SDRs and EDRs

Programmatic

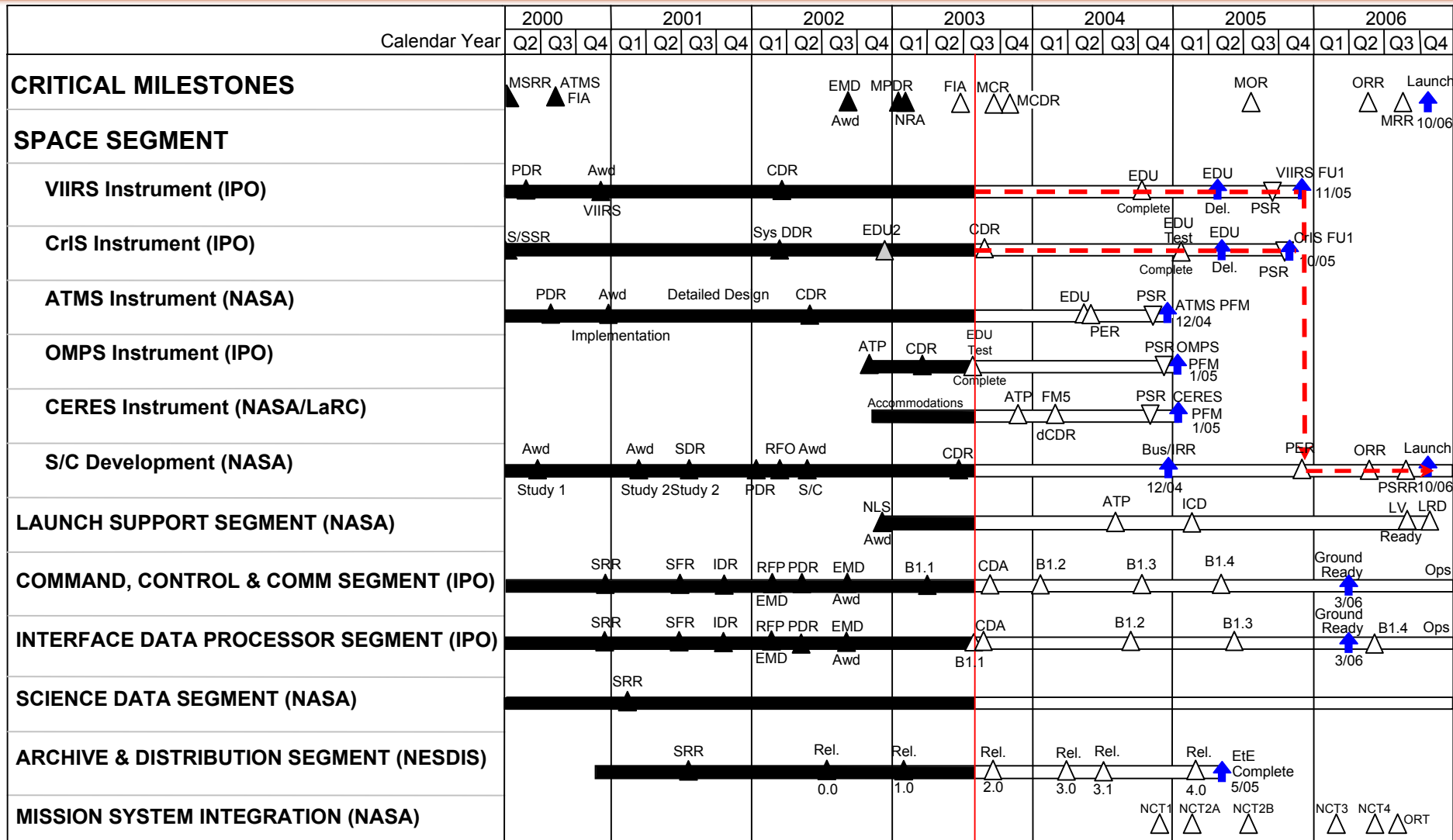
Key Documentation Status

| | |
|--|---------------------------|
| Code Y Bridge Mission Direction Letter | Complete |
| Formulation Authorization Document | Complete |
| Mission Level 1 Requirements | Draft - HQ |
| Mission Success Criteria | Pending -HQ |
| Final Implementation Agreement (NASA/IPO) | Draft - HQ |
| Final Implementation Agreement – ADS (NASA/NOAA) | Pending - HQ |
| ATMS Instrument Implementation Agreement (NASA/IPO) | Complete |
| Project Plan | Draft |
| Program Configuration Management Plan | Complete |
| Risk Management Plan | Complete |
| Mission Requirements Specification (Volume 1 and 2) | Complete |
| System and Operations Concept (Volume 1 and 2) | Complete |
| System Engineering Management Plan Implementation Phase | In Signature Cycle |
| System Safety and Mission Assurance Plan | Complete |
| Program Information Technology Plan | Complete |
| Environmental Impact Assessment (Worksheet) | Draft |
| Debris Assessment Preliminary Report | Complete |
| Project Service Level Agreements | In Review |



NPOESS Preparatory Project (NPP)

Level 1 Joint Master Schedule

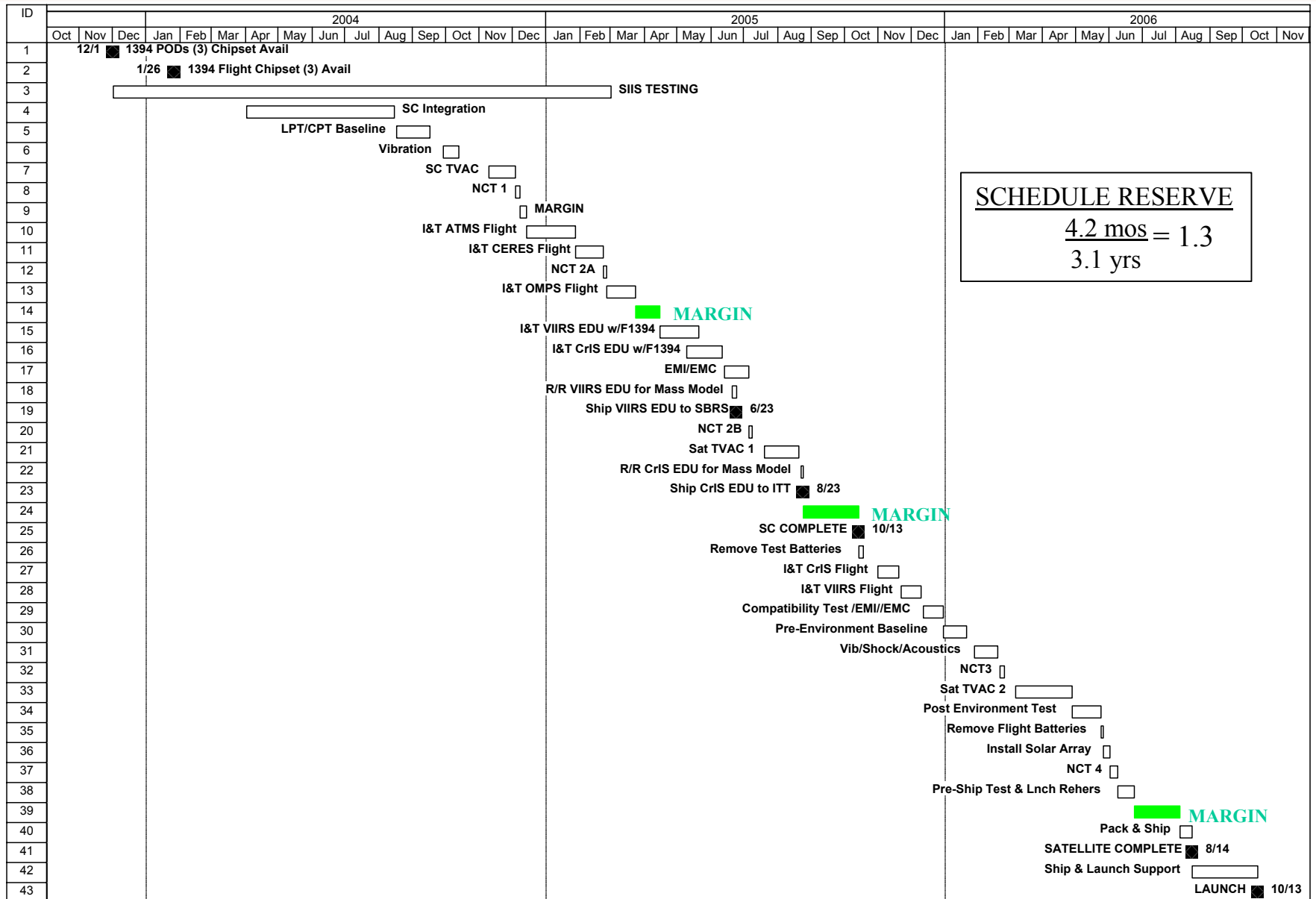
Status as of 7/30/03



Project Manager B/L Approval: _____ Original Signed by _____ 8/1/03
James G. Watzin Date

Legend:  Critical Path  Controlled Milestone

Integration and Test Flow



Schedule Features

- **The NPP Integration & Test (I&T) schedule has been designed to maximize flexibility, mitigate risk, and minimize cost impacts due to late hardware deliveries.**
- **Due to the inter-agency nature of NPP, the Project has put in place a jointly agreed upon I&T flow that allows for:**
 - Integration of the sensors onto the spacecraft without a prescribed order
 - The incorporation of Engineering Development Unit (EDU) hardware and flight-like simulators to allow early interface verification with the spacecraft
 - EDUs provide the opportunity for completion of the majority of spacecraft testing without having all flight sensors present
 - Logical “breakpoints” that allow for suspension of work to accommodate late deliveries or unexpected technical problems with the sensors

Phased NOA Requirements

NPP POP 03-1 NOA REQUIREMENTS (\$M)

(Direct, Not Full Cost)

| | <u>PRIOR YEARS</u> | <u>FY03</u> | <u>FY04</u> | <u>FY05</u> | <u>FY06</u> | <u>FY07</u> | <u>TOTAL</u> |
|---------------------------|------------------------|-------------|-------------|-------------|-------------|-------------|--------------|
| SPACECRAFT | | | | | | | |
| ATMS | | | | | | | |
| LAUNCH SYSTEMS | | | | | | | |
| GROUND SYSTEMS | | | | | | | |
| PROJECT SUPPORT | | | | | | | |
| CERES ADDITION | | | | | | | |
| CONTINGENCY | | | | | | | |
| TOTAL REQUIREMENTS | | | | | | | |

Phased Cost Requirements

NPP Budget Basis of Estimates (1)

- **Spacecraft**
 - \$X spent on Rapid Spacecraft studies prior to delivery order
 - \$X budgeted for fixed-price delivery order includes funding for special studies and potential changes for instrument accommodations
 - \$X for engineering oversight and 1394 technology evaluation
- **ATMS**
 - \$X spent on Preliminary Design contracts prior to development contract award
 - \$X budgeted for Development contract; based on latest EAC, offset for anticipated descopes, and increased for latest LRD
 - \$X for engineering oversight activities
- **CERES Addition**
 - \$X based on LaRC estimates for completion of instrument testing and integration, and LaRC oversight support
- **Launch Services**
 - \$X based on latest estimate from KSC for Delta 7920 class launch vehicle with 10/06 LRD

NPP Budget Basis of Estimates (2)

- **Ground Systems**

- \$7.3M to provide In-Situ Ground Terminal prototype for future commercialization to support Direct Broadcast community
- \$4.0M earmark funding in prior years
- \$0.2M for prior year evaluation of alternative FPGA technologies
- \$8.2M in FY03 and prior to develop Science Data Segment concepts and risk reduction activities (no future SDS funding currently budgeted)

- **Project Support**

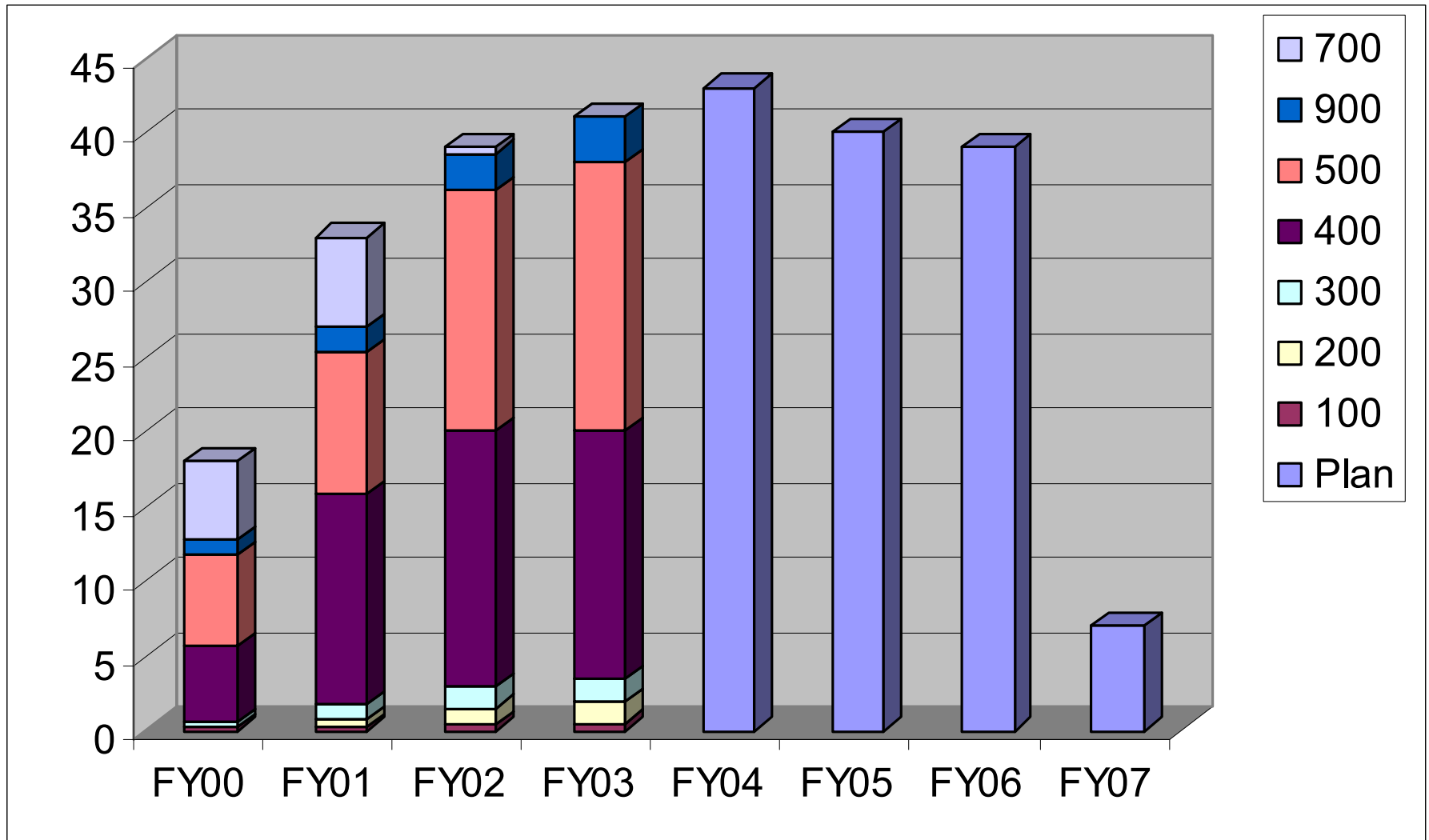
- \$18.7M for mission-level systems engineering, risk management, and IV&V
- \$9.5M to support scientific cal/val and algorithm infrastructure activities with IPO
- \$4.3M for Safety and Mission Assurance support
- \$2.6M for Project Control support (CM, scheduling, general support)
- \$17.9M MPS
- \$10.5M for general project support, primarily Directorate and Program office assessments

- **Contingency**

- Approximately 23% of cost to complete, excluding Launch Services

Full Cost Budget Roll-up

Manpower Estimates



Risk Management

- **NPP implements a joint NASA and IPO Risk Management Plan (GSFC 429-99-01-04)**
 - Risks discussed / dispositioned within SEWG along with senior NPP Management on a monthly basis
 - Risks managed at the NPP-level are primarily at the system level
- **Risks are strategic in nature with a focus on down stream impacts to IMS Level I Milestones**
- **NPP also utilizes the Top Ten list that focuses on tactical problems / issues that the project is currently working**

NPP Fever Chart

NPP PROJECT SUMMARY

August 18, 2003

INSTRUMENTS

| | MAY | JUN | JUL |
|------------------------|-----|-----|-----|
| <u>ATMS (GSFC)</u> | | | |
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |
| COST | G | G | G |
| <u>CERES (GSFC) **</u> | | | |
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |
| COST | G | G | G |
| <u>ChS (IPO)</u> | | | |
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |
| <u>VIIRS (IPO)</u> | | | |
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |
| <u>OMPS (IPO)</u> | | | |
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |

** NOT FORMALLY ADDED TO THE PROGRAM

LEGEND

| | |
|----------------|---|
| GOOD SHAPE | G |
| MINOR PROBLEMS | Y |
| MAJOR PROBLEMS | R |

SPACECRAFT

| | MAY | JUN | JUL |
|-------------------------------|-----|-----|-----|
| TECHNICAL | G | G | G |
| SCHEDULE | G | G | G |
| COST | G | G | G |
| <u>GROUND SYSTEM SEGMENTS</u> | | | |
| C3S (IPO) | G | G | G |
| IDPS (IPO) | G | G | G |
| ADS (NOAA) | G | G | G |
| SDS (GSFC) | Y | Y | Y |

MISSION RESERVES

| | MAY | JUN | JUL |
|----------|-----|-----|-----|
| SCHEDULE | G | G | G |
| BUDGET | G | G | G |

MISSION

| | MAY | JUN | JUL |
|--------------------|-----|-----|-----|
| TECHNICAL | G | G | G |
| IEEE-1394 | Y | Y | Y |
| INTEGRATION & TEST | G | G | G |
| LAUNCH SERVICES | G | G | G |
| P.A. / SAFETY | G | G | G |
| SCIENCE | G | G | G |
| SCHEDULE | G | G | G |
| COST (R&D BUDGET) | G | G | G |
| PROCUREMENT | G | G | G |
| STAFFING | G | G | G |
| TRAVEL | G | G | G |

SUMMARY ASSESSMENT

| | TECH | COST | SCHED | PM | OVERALL |
|-----------------|------|------|-------|----|---------|
| INSTRUMENTS | G | G | G | G | = G |
| SPACECRAFT | G | G | G | G | = G |
| MISSION | Y | G | G | G | = Y |
| GROUND SEGMENTS | Y | G | G | G | = Y |
| LAUNCH SERVICES | G | G | G | G | = G |
| OVERALL | | | | | Y |

Top Ten

NPOESS Preparatory Project (NPP)

STATUS AS OF: 8/18/03

| PROBLEMS/ISSUES | PROGRAMMATIC IMPACT | ACTION | DATE | |
|--|--|---|--------|--------|
| | | | ESTAB. | COMPL. |
| <div>Y</div> Delay in approval of SDS scope by Headquarters. | <ul style="list-style-type: none"> • Delay in SDS acquisition will impact ability of SDS to influence IDPS design, and to be ready to contribute to Long Term Climate Record at NPP launch • Delay in SDS recognition & authorization prevents incorporation as external interface in IPO/NGST SSBR contract | <ul style="list-style-type: none"> • Working with Code 900 and HQ/Y to approve SDS scope | 3/03 | 8/03 |

CURRENT STATUS

- The Project received updated draft SDS Level 1 requirements from HQ on July 30, 2003.
- NPP Project Management met with HQ on July 31 to discuss the latest version of the Level 1 requirements. The Project has the action to generate comments that will be discussed in another face-to-face meeting planned for August 8, 2003.
- Progress continues to be made towards agreement on the Mission level 1 Requirements which include the SDS

Top Ten

NPOESS Preparatory Project (NPP)

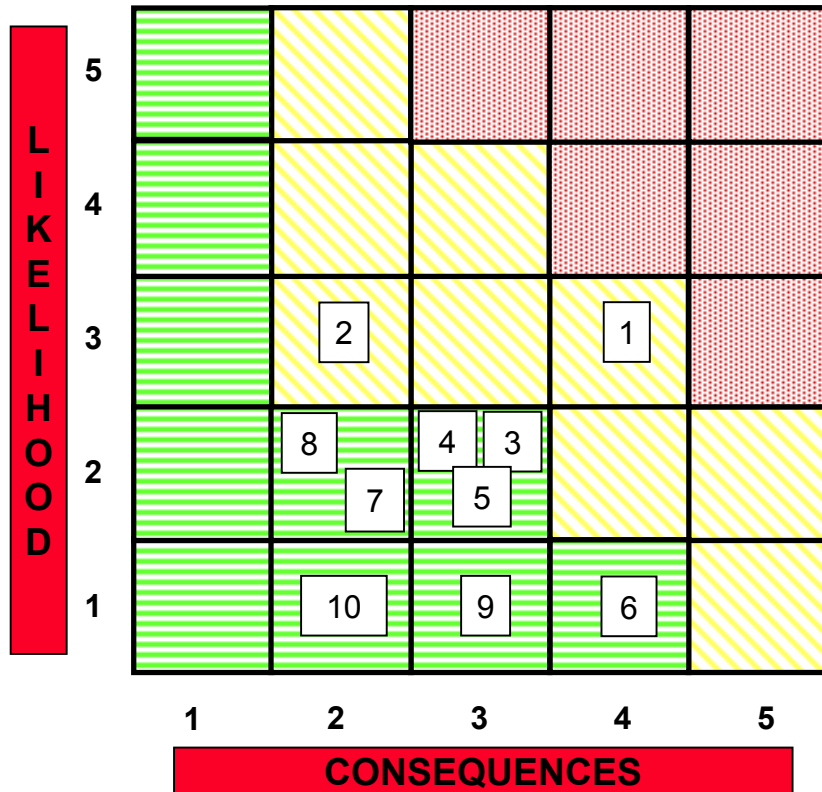
STATUS AS OF: 8/18/03

| PROBLEMS/ISSUES | PROGRAMMATIC IMPACT | ACTION | DATE | |
|--|--|--|--------|--------|
| | | | ESTAB. | COMPL. |
| Y IEEE 1394 Flight Qualified Chipset Development Problems and Delays <ul style="list-style-type: none"> Lack of chipset maturity and availability to support NPP Spacecraft, CrIS, and VIIRS Instrument developments | <ul style="list-style-type: none"> Impact to VIIRS, CrIS, and NPP development schedules Potential impact to Engineering and Flight hardware deliveries Potential impact to Integration and Test fidelity due to use of commercial parts in testing Potential cost impact to NPP spacecraft | <ul style="list-style-type: none"> Continue to track ASIC development schedule and delivery dates Continue to use commercial ship sets and Field Programmable Gate Array (FPGA) version of in Engineering and Flight in hardware Re-assess mission risk exposure for planned 1394a development effort Develop alternative approach, i.e. 1355 Space Wire | 03/03 | 2/04 |

CURRENT STATUS

- IPO/Aeronix has completed the analysis phase of the chip-to-chip margins testing for the UTMIC devices. Internal chip margins testing looks good, but the analysis has identified several areas that have less system margin (chip-to-chip) than desired. Chip-to-chip margin testing using PODs is underway
- Delivery of the 1394 Prototype boards to the NPP hardware teams has begun. The board utilizes Field Programmable Gate Arrays and discrete components to emulate the 1394 ASIC code
- The CDR for the UTMIC APHY ASIC was successfully held on July 31


NPP Risk Summary August 1, 2003



| Criticality | Approach |
|-------------|--------------|
| High | M - Mitigate |
| Med | W - Watch |
| Low | A - Accept |
| | R - Research |

| Risk & Trend | Risk ID | Approach | Title |
|--------------|----------|----------|--|
| 1 | NPP - 14 | M | IDPS EDR Processing Availability at NPP Launch |
| 2 | NPP - 17 | M | ATMS RF Modules (Noise Power Stability) |
| 3 | NPP - 20 | W | CrIS Detectors |
| 4 | NPP - 16 | W | CrIS Jitter |
| 5 | NPP - 18 | W | CrIS Interferometer Development |
| 6 | NPP - 13 | W | NOAA SOF Availability |
| 7 | NPP - 15 | M | ATMS Scan Drive Electronics |
| 8 | NPP - 21 | M | Gunn Diode Life Testing Failure Rate |
| 9 | NPP - 19 | W | VIIRS Modulated Infrared Background (MIB) |
| 10 | NPP-12 | M | Spacecraft / Instrument Integration |

NPP Medium Risks

| Rank |  | Risk Statement | Approach & Plan | Status |
|---|---|--|---|--|
| 1. IDPS EDR Processing Availability at NPP Launch NPP-14 Expected Closure: Ongoing thru launch | | <p>If: IDPS sensor algorithms are not mature or complete at NPP launch</p> <p>Then: cal/val activities for some EDRs will not be able to be completed at launch</p> | Mitigate : IPO working with SSPR to identify detailed cost and schedule plan for algorithm development as part of IBR activity | <ul style="list-style-type: none"> • NPOESS re-baselining activities ongoing. NGST updated Appendix D in late May to reflect expected EDR perf. for NPP. Appendix E is updated to identify which EDRs do not have to meet NPOESS Performance for NPP. CCR in progress. |
| 2. ATMS RF Module NPP-17 Expected Closure: Final delivery of RF Module (8/03) | | <p>If: RF modules do not meet performance requirements (Noise Power Stability)</p> <p>Then: There is a potential that the instrument will not achieve required science performance</p> | Mitigate: NGES / BAE selecting, through test, only the best performing devices | <ul style="list-style-type: none"> • All EM-2 RF Modules delivered (Ka will utilize EM-1 Module). BAE currently dicing second spin Ka wafers for testing • Noise levels appear to be acceptable. Risk will be re-assessed when all EDU RF modules complete testing and results are incorporated in the system perf. model. |

Review History

- **Mission System Requirements Review (MSRR) 3/00**
- **ATMS Preliminary Design Review (PDR) 7/00**
- **SDS System Requirements Review (SRR) 2/01**
- **Spacecraft Preliminary Design Review (PDR) 1/02**
- **ATMS Critical Design Review (CDR) 5/02**
- **Spacecraft Baseline Design Review (BDR) 12/02**
- **Independent Mission Preliminary Design Review (IMPDR) 1/03**
- **Spacecraft Critical Design Review (CDR) 6/03**

Peer Review

- **Project Peer Review policy not previously formalized, but now is in work**
- **Peer Review Policy / Approach**
 - All technical focus areas shall be reviewed (i.e. Subsystems, mission uniques, specialty topics, problem areas, etc.)
 - Formal action items shall be generated, tracked, and approved by Project Chief Engineer
- **Integrated (GSFC, Ball, IPO, NGST) peer reviews conducted for many elements of the Mission**

Other

- **RF frequency application submitted by IPO for NPP**
 - Operational aspects of NPP / NPOESS commonality required
- **NASA NPP has no international partners requiring formal documentation**
 - IPO maintains all formal documentation associated with export/import control aspects of the Mission, i.e. Svalbard, Direct Broadcast Users, etc.

The logo is a circular emblem. The outer ring contains the text "NPOESS PREPARATORY PROJECT" at the top and "THREE AGENCIES • ONE MISSION" at the bottom. The center features a stylized globe with a satellite in orbit. A rainbow arc is positioned behind the globe, and several stars are scattered in the lower right quadrant.

NPOESS Preparatory Project (NPP)

Project Summary / Response

Jim Watzin
Project Manager

August 26, 2003

Project Response Summary

- **Project concurs with all Review / Audit findings**
 - All non-compliances will be corrected
 - All issues will be addressed and closed-out with appropriate organizations
 - All concerns will be explored and will be coordinated with appropriate organizations
- **Project will continue to work closely with HQ to finalize key Mission Documentation**
 - Mission Level 1 Requirements
 - Final Implementation Agreement
 - Implementation Agreement with NOAA for ADS
 - Mission Success Criteria

SMO Assessment Project Response

- **Systems Management Office (SMO) Assessment identified several areas requiring action**
 - Integrated Review Plan
 - Project had been following the detailed plan that had been generated more than a year ago, but was not signed
 - Integrated Review Plan has been coordinated with the SMO and is currently in signature cycle
 - Peer Review Plan
 - Project recognizes the lack of a formalized peer review plan and is in the process of generating a plan that includes policy and implementation details
 - Mission Reliability Assessments
 - Individual hardware elements have completed their appropriate reliability assessments (including IPO provided hardware) and have delivered the reports to the Project for incorporation into a mission level assessment
 - Mission reliability assessments, including FMEAs, fault tree analyses, probability of success, and single point failure assessments have been initiated and initial Project assessments due by the end of September 2003

SMO RAO Project Response

- **SMO Resource Analysis Office (RAO) Parametric Cost Estimate correlates well with the Project's Grass Roots Estimate when adjusted for model inconsistencies**
 - The project estimate includes full cost only for NOA received after FY03; the RAO estimate assumes full costs for the entire project budget
 - The RAO spacecraft estimate is based on large CPAF missions such as POES, and doesn't recognize the RSDO heritage of the BCP 2000 bus, and the fixed-price nature of the contract
 - The RAO Mission I&T estimate is based on an all-mission historical average which assumes a lengthy I&T period, and ignores the planned use of instrument EDUs to mitigate schedule and cost risk
 - The RAO Project Support estimate is also based on an all-mission average, and assumes a much longer than anticipated project duration
 - The RAO models predict cost performance from PDR, and doesn't recognize performance to date
 - The RAO contingency is based on 30% of estimated cost to complete, vs. the 23-24% project estimate

SMO 7120.5B Audit Project Response (1)

- **SMO NPG 7120.5B audit findings are being addressed**
 - Non-compliances
 - Integrated Review Plan
 - Project had been following the detailed plan that had been generated more than a year ago, but was not signed
 - Integrated Review Plan has been coordinated with the SMO and is currently in signature cycle
 - System Internationale (SI) Unit Policy and Waiver
 - Neither the Project Plan or the Systems Engineering Management Plan (SEMP) explicitly call out the Project's SI unit policy statement. Both documents will be revised to capture this deficiency
 - The Project does have a controlling SI unit requirement which is contractually levied on all hardware contracts (including IPO)
 - General Instrument Interface Document (GIID), dated August 6, 2001

SMO 7120.5B Audit Project Response (2)

- **SMO NPG 7120.5B audit findings are being addressed (continued)**
 - System Internationale (SI) Unit Policy and Waiver (continued)
 - The GIID requires the use of metric units, but does allow for dual marking at the interfaces
 - The GIID also requires that any hardware, for whatever reason, that needs to use English units will be required to seek a waiver
 - To date, no subsystem has sought a waiver
 - The Project is in the process to verifying compliance to the requirement
 - In summary, the Project doesn't believe a waiver is currently required
 - Surveillance Plans commensurate with risk
 - Although the Project relies heavily on surveillance of all hardware contracts, a formalized plan is not in place
 - The Project is incorporating our current surveillance approach, into a consolidated Project Surveillance Plan

SMO 7120.5B Audit Project Response (3)

- **SMO NPG 7120.5B audit findings are being addressed**
 - Planning deficiencies
 - **Project Plan content**
 - Project Plan revision to capture Level 1's, Mission Success, knowledge, and Tailoring
 - **Utilizing and Contributing to Center's Knowledge**
 - Project Plan revision to capture approach and implementation method
 - **Facility availability for SDS**
 - Current DRAFT requirements state that SDS is a distributed system that could be located anywhere – this concern is n/a
 - **Project Performance Metrics Identification**
 - Project Plan revision to capture appropriate metrics will be generated

Non-Advocate Review Team Assessment

Project Response (1)

- **Non-Advocate Review Team identified several area requiring action**
 - IEEE-1394 Development Delays
 - Project recognizes importance and potential impact of the 1394 development effort with respect to overall technical, schedule and cost performance
 - NPP Chief Engineer actively engaged with IPO, Ball, and NGST to insure all stakeholders are coordinated (requirements, performance trades, schedule, and procurement)
 - ATMS Development
 - Problem is not new, Project is very sensitive to ATMS development performance and has applied additional resources to manage this concern
 - VIIRS Flight Unit Delivery
 - Project recognizes the importance of not only VIIRS, but all IPO provided sensors with respect to overall technical, schedule and cost performance
 - Project regularly participates in progress reviews and design reviews
 - NPP I&T schedule reworked to allow for out of sequence integration of sensors and incorporation of EDUs and simulators to minimize risk early in the flow and complete spacecraft testing

Non-Advocate Review Team Assessment

Project Response (2)

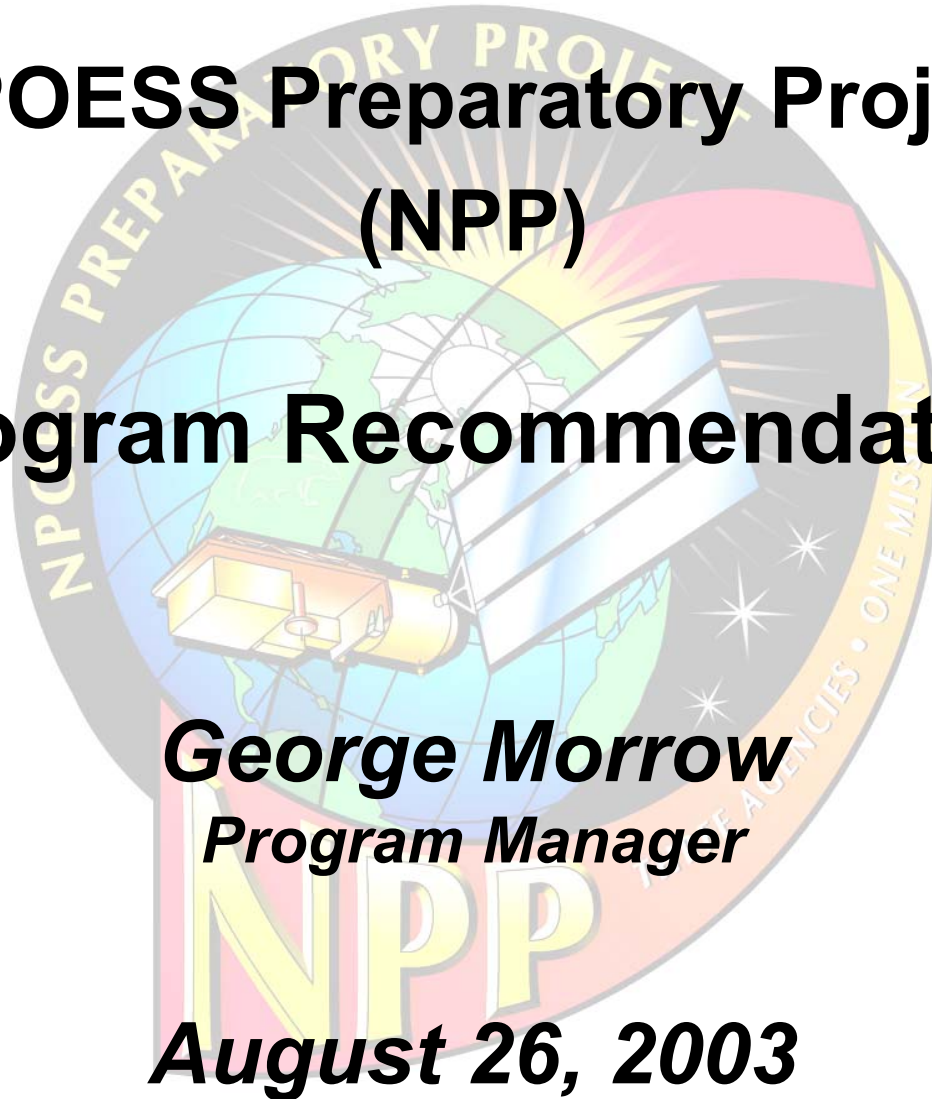
- **Non-Advocate Review Team identified several area requiring action**
 - Interface Control Drawing (ICD) Closure
 - Coordination of ICD information was impacted by several Program level actions (transfer of IPO sensor contracts to NGST and the NPOESS replan)
 - Problem came to a head just before the spacecraft CDR in June 2003 when work-off plan had to be developed to insure timely closure
 - Project and IPO recognize the importance of ICD closure and are aggressively working to bring closure by the Mission CDR in October

NPOESS Preparatory Project (NPP)

Program Recommendation

George Morrow
Program Manager

August 26, 2003



Recommendation

- **Key Mission Documentation must be finalized in a timely manner to insure Project continuity**
- **Acceptable plan for closure of MCRR findings and actions is in place**
- **Development cycle maturity is well beyond that typically required for confirmation**
- **Recommend NPP proceed**